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*For Aviation Operations Research*

# **The National Center of Excellence for Aviation Operations Research**

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# NEXTOR Summary

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- NEXTOR Program Overview
  - Vision and strategic goals
  - Leadership and administrative organization
- NEXTOR and the FAA Flight Plan
  - Aviation safety
  - Increased Capacity
  - Organizational excellence
  - International leadership
- What's next for NEXTOR
  - Challenges
  - Opportunities
  - NEXTOR Next year

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## **NEXTOR Program Overview**

- Vision and strategic goals
- NEXTOR directors
- Program Office

# Vision and Strategic Goals

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- To lead the aviation community by advancing new ideas and paradigms for aviation operations, educating and training aviation professionals, and promoting knowledge exchange among industry, government, and academic leaders
  - Continue to build on our strong base of collaborative research and innovative thinking that will address critical needs in the NAS
  - Increase the breadth of aviation operations research knowledge through short courses and degree programs at each of the NEXTOR universities
  - Sponsor frequent conferences and seminars among the senior leadership of the aviation industry, government, and academia



# NEXTOR Directors

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- Managed by an Executive Committee composed of one Co-Director from each of the five NEXTOR universities
  - Dr. Michael Ball, University of Maryland
  - Dr. Arnie Barnett, Massachusetts Institute of Technology
  - Dr. George Donohue, George Mason University
  - Dr. Mark Hansen, University of California, Berkeley
  - Dr. Toni Trani, Virginia Tech
- Responsibilities of the Executive Committee
  - Provide strategic direction for the consortium
  - Respond to requests for research or educational services
  - Provide oversight for the NEXTOR Program Office

# NEXTOR Program Office at the University of California, Berkeley

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- Provides program office support to the five universities that comprise the NEXTOR consortium
  - Includes organizational structure, management and operations for NEXTOR
  - Provides “single face to the customer” for all NEXTOR administrative and operational issues
  - Enhances outreach efforts from NEXTOR to the aviation operations and research community
  - Generates interest in aviation operations research among university students and researchers
  - Facilitates communication between researchers and project sponsors for all five NEXTOR universities

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## **NEXTOR and the FAA Flight Plan**

- Safety
- Increased capacity
- Organizational Excellence
- International leadership

# NEXTOR and Aviation Safety

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- Safety Oversight System Analysis – PI – Dr. Mark Hansen – University of California, Berkeley
  - Developed comprehensive history of Aviation Oversight in the United States from the dawn of aviation to the present
  - Completed comparison of aviation safety oversight systems in industries with a comparable requirement for extremely low failure rates
- Health of An Air Carrier from the Perspective of Safety – PI – Dr. Arnie Barnett – MIT
  - Produced several reports, including
    - On the FAA's Proposed New System-wide Air Safety Indicator
    - The Health of an Air Carrier from the Perspective of Safety
  - Developing an experiment to exploit information technology and analysis methods to improve tests for aviation safety compliance
- Probabilistic Assessment of Wake Turbulence Risk – PI – Dr. George Donohue – George Mason University



# NEXTOR and System Capacity

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- Congestion Management at La Guardia Airport – Co-PIs Dr. Karla Hoffman, George Mason University, and Dr. Michael Ball, University of Maryland
  - Develop concepts for an economically efficient allocation of scarce resources
  - Conducted several strategic games to discover operational and administrative issues and to determine how players might react to future scenarios
    - Showed opportunity for opening lines of communication between system participants
    - Excellent discovery process for government and industry
- CDM support – Co-PIs – Representatives from all NEXTOR universities
  - Continuing work in support of efforts to more effectively manage weather and volume related delays at major airports

# NEXTOR and Organizational Excellence

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- Strategy simulator – Co-PIs – Researchers representing all NEXTOR universities
  - System dynamics model to determine National Airspace system response to industry, economic, political, and other governmental inputs
  - Development focused on how potential world and industry developments might impact the FAA revenue stream
- Development of performance measures and facility condition indices – PI – Dr. Mark Hansen, University of California, Berkeley, with Dr. Jasenka Rakas
  - Initiated project to develop Facility Condition Indices for unstaffed facilities and a portion of the non-operational infrastructure
  - Expectation that we will eventually be able to develop buy-maintain-dispose benefit assessments

# NEXTOR and International Leadership

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- Students and international excellence
  - Strong international representation at all NEXTOR universities
  - Students (domestic and international) among the highest scorers among Graduate Record Exams
    - Example: 9 of 22 entering Transportation Program graduate students at UC Berkeley in 2004 scored a perfect 800 on quantitative portion of GRE
  - “The sun never sets on the NEXTOR student empire”
- Sponsored NEXTOR - MIT conference on how Aviation Impacts the Economies of Developing Countries
  - Brought together World Bank, industry representatives and international business community in a discussion of the positive impact of aviation in international economic development
- Exchanges with European universities
  - Robust exchange program with students from key aviation programs at universities in France
  - Frequent cross-flow of information and presentation of seminars among NEXTOR researchers with Imperial College, London

# NEXTOR and International Leadership

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- Concerns regarding international leadership in the university environment
  - Large numbers of outstanding international students remain grounded
    - 27 international applicants to UC Berkeley transportation program in 2004 with perfect 800 GRE quantitative scores were turned down for a lack of financial support
    - Incredible reservoir of knowledge and capability is being squandered or diverted to non-transportation fields
  - Project support from the FAA is critical to improving flow in this valuable pipeline, noting the following:
    - Many international students remain in the U.S. on graduation and provide input to the FAA as contractors, University researchers, or professors
    - Those returning to home countries do so with experience of working on FAA projects
  - Restrictions on citizenship of researchers must be carefully weighed because it could constrict an incredibly valuable pipeline of knowledge

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## **What's next for NEXTOR?**

- Challenges
- Opportunities
- NEXTOR next year

# NEXTOR Key challenges

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- Uncertain resources
  - Traditionally funded on a project by project basis
    - Drives yearly resource challenges
    - No budget line
    - No congressional earmarks
- Organizational Changes within the FAA
  - Re-organization of ATO creates requirement to affirmatively fund projects
  - Experiencing multi-month delays in initial and incremental funding due to changeover in FAA accounting systems

# Opportunities for NEXTOR

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- Uncertain resources drive innovative and collaborative development opportunities
  - Bringing airports into the picture on system analysis projects
  - Looking to NASA and DOD to sponsor certain research
  - Enhance and improve the industry partner program
  - Desire to bring international partners into more active participation
- Organizational changes and move for organizational excellence in the FAA drives to the heart of operations research
  - Short-term research focusing on search for efficiencies and streamlining of processes in Air Traffic Organization
  - Desire to participate in long term system development efforts through NGATS and the Joint Planning and Development Office

# Unique assets NEXTOR can provide to meet FAA research requirements

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- Relative academic standing
  - Times of London Higher Education Supplement (THES) rankings of world universities based on “a set of criteria valued around the world”
    - University of California, Berkeley: #2
    - Massachusetts Institute of Technology: #3
    - (Number one was Harvard University, a NEXTOR affiliate university participating in the Congestion Management Project)
  - US News and World Report Graduate School Rankings
    - Engineering Schools: MIT #1, UCB #3, UMD #16
    - Schools of Business: MIT#4, UCB #7
    - Aerospace Engineering: MIT #1, UMD #10
    - Civil Engineering: UCB #1, VPI #12
- Unparalleled faculty and strong stable of industry partners
  - 10 core faculty members representing collectively over 150 person-years of aviation-related research
  - Ability to leverage industry partnerships when unique industry expertise and/or project requirements dictate



# Unique assets NEXTOR can provide to meet FAA research requirements

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- Ability to bring some of the foremost students in the world to work with researchers on aviation issues and analyses
  - Allows the FAA to tap the best young minds for tomorrow's challenges
  - Structure of NEXTOR allows students to continue their FAA-related research career through post-doctoral positions at NEXTOR universities
  - Extensive record of graduates moving into academic and industry positions in support of the FAA
- Ability to provide high-value, low cost, unbiased, assessments
  - Access to industry partner and university developed modeling and simulation and economic analysis tools
  - Commitment to academic excellence versus program growth
  - Substantial majority of researcher salaries funded by universities
  - Working with a very small non-research professional staff



# NEXTOR Next year

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- Continue work in support of the FAA Flight Plan
  - Continue safety analysis and assessment work
  - Enhancement of strategy simulator activities
  - Congestion management initiatives
  - New initiative with a project structure similar to the Congestion Management project
- Continue to expand outreach efforts with other organizations, both domestic and international
  - Outreach with Euro-control and European universities
  - Expansion of discussions with Asia
- Continuation of education and knowledge exchange initiatives
  - Congestion management and Performance measurement conferences slated for later this year

# Summary

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- NEXTOR is a vibrant research and education organization with outstanding capabilities and resources for the FAA
- Projects, faculty interests, and expertise span all four major thrusts of the FAA Flight Plan
- Challenges and opportunities are in abundance at NEXTOR and the FAA, and we expect to meet the challenges and embrace the opportunities that come our way